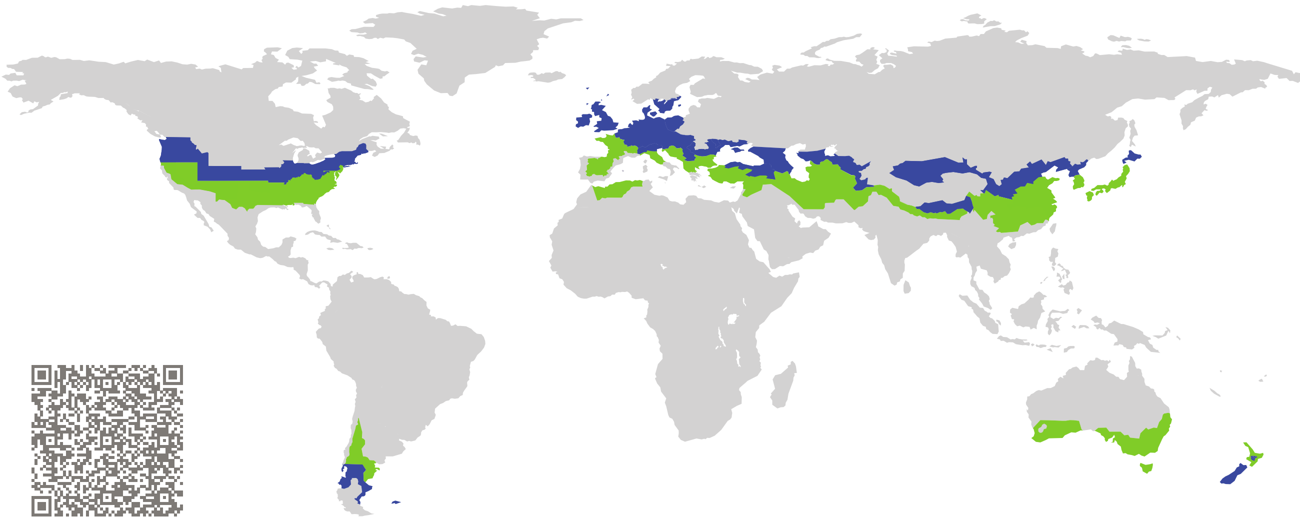
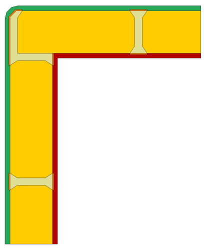
CERTIFICATE

Certified Passive House Component

Component-ID 2121cs03 valid until 31st December 2025

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany





Category:	**Construction system**
Manufacturer:	**Fachverband Strohballenbau Deutschland e.V., Verden, Niedersachsen, Germany**
Product name:	**straw bale wood frame construction plaster - plaster**

Hygiene criterion

The mininum temperature factor of the interior surfaces is $f_{Rsi=0.25\,m^2\,K/W} \geq$ 0.70

Comfort criterion

The U-value of the installed windows is $U_{wi} \leq$ 0.85 W/(m² K)

Efficiency criteria

Heat transfer coefficient of building envelope: $U * f_{PHI} \leq$ 0.15 W/(m² K)

Temperature factor of opaque junctions: $f_{Rsi=0.25\,m^2\,K/W} \geq$ 0.86

Thermal bridge-free design for key connection details: $\Psi \leq$ 0.01 W/(m K)

An airtightness concept for all components and connection details was provided.

It was confirmed that the structure will dry out within 12 months and there is no risk of moisture-related damage.

cool, temperate climate

CERTIFIED COMPONENT

Passive House Institute

Opaque building envelope

The thermal insulation of the system consists of straw bales, which are lined with clay plaster on the inside and lime plaster on the outside. The bales are fitted into a timber construction (60/340), e = 1.0 m. The construction rests on a floor slab that is insulated with cellulose on the inside. Several variants with different kinds of perimeter insulation were considered The roof is also insulated with straw bales. A clay board closed off to the room, and a soft fiber board closed to the outside. In addition, a variant with cellulose insulation was considered.

Windows

The certification was done with the timber window smartwin compact (1). In addition, the calculations were carried out for an oak-window with triple glazing (2).

Airtightness concept

The airtight layer of the walls is formed by the 3-layer clay plaster, in the 2nd layer of which a reinforcement fabric is incorporated. The connection to the windows is made by plasterable adhesive tapes. The airtight layer of the roof is a membrane that protrudes towards the walls and is plastered in.

Summary of values

Opaque assemblies		U-value W/(m² K)	Thickness mm
exterior wall	(EW1)	0.15	420
flat roof	(FR1)	0.13	434
floor slab	(FS1)	0.20	400
pitched roof	(RO1)	0.13	434
pitched roof	(RO2)	0.15	353
top floor ceiling	(TC1)	0.13	434

Frame Cuts with "smartwin" from "pro Passivhausfenster GmbH" (0905ws03)				
Frame values	Frame width b_f mm	*U*-value frame U_f W/(m^2 K)	Ψ-glazing edge Ψ_g W/(m K)	Temp. Factor $f_{Rsi=0.25}$ [-]
Bottom (OB1) 	76	0.93	0.020	0.72
Top (OH1) 	67	0.71	0.021	0.75
Lateral (OJ1) 	67	0.71	0.021	0.75
Threshold (OT1) 	76	0.97	0.020	0.72
Spacer: SWISSPACER Ultimate		Secondary seal: Polyurethan		

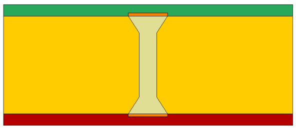
Frame Cuts with "triple glazed oak window" from "Fachverband Strohballenbau Deutschland e.V." (1867wi03)					
Frame values		Frame width b_f mm	U-value frame U_f W/(m^2 K)	Ψ-glazing edge Ψ_g W/(m K)	Temp. Factor $f_{Rsi=0.25}$ [-]
Bottom	(OB2)	131	1.86	0.028	0.71
Top	(OH2)	114	1.55	0.029	0.72
Lateral	(OJ2)	114	1.55	0.029	0.72
Threshold	(OT2)	240	1.61	0.028	0.57
Spacer: SWISSPACER Ultimate			Secondary seal: Polysulfide		

Junctions		U1	U2	U3 W/(m^2 K)	Ψ-value Ψ W/(m K)	Temp. factor $f_{Rsi=0.25}$ [-]
Ceiling integration into exterior wall (EW1_EW1_CE_1)		0.15	0.15		0.008	0.929
Ceiling integration into exterior wall (EW1_EW1_CE_1)		0.15	0.15		0.017	0.920
Exterior corner exterior wall (EW1_EW1_ec_1)		0.15	0.15		−0.085	0.919
Interior corner exterior wall (EW1_EW1_ic_1)		0.15	0.15		0.039	0.957
Internal wall integration into exterior wall (EW1_EW1_IW_1)		0.15	0.15		−0.001	0.953
Roof parapet flat roof (EW1_FR1_rp_1)		0.15	0.13		−0.071	0.905
Window bottom operable window in exterior wall (EW1_OB1_1)		0.15	1.86		0.022	0.616
Window bottom operable window in exterior wall (EW1_OB1_2)		0.15	1.86		0.028	0.823
Window head operable window in exterior wall (EW1_OH1_1)		0.15	0.71		0.005	0.865
Window head operable window in exterior wall (EW1_OH1_1)		0.15	1.55		0.021	0.715
Window jamb operable window in exterior wall (EW1_OJ1_1)		0.15	0.71		−0.001	0.827
Window jamb operable window in exterior wall (EW1_OJ1_1)		0.15	1.55		0.015	0.717
Roof eave pitched roof (EW1_RO1_ea_1)		0.15	0.13		−0.033	0.911
Roof verge pitched roof (EW1_RO1_ve_1)		0.15	0.13		−0.075	0.896
Roof eave pitched roof (EW1_RO2_ea_1)		0.15	0.15		−0.026	0.913
Roof verge pitched roof (EW1_RO2_ve_1)		0.15	0.15		−0.067	0.892

Junctions	U1	U2	U3	Ψ-value	Temp. factor
	W/(m² K)			Ψ W/(m K)	$f_{Rsi=0.25}$ [-]
Roof eave exterior wall to top ceiling with cold roof (EW1_TC1_RO_ea_2)	0.15	0.13		−0.069	0.905
Threshold to floor slab (FS1_EW1_OT1_1)	0.20	0.15	1.61	0.016	0.575
Threshold to floor slab (FS1_EW1_OT2_1)	0.20	0.15	0.97	−0.025	0.772
Exterior wall plinth on floor slab (FS1_EW1_1)	0.20	0.15		−0.034	0.844
Exterior wall plinth on floor slab (FS1_EW1_2)	0.20	0.15		−0.032	0.844
Exterior wall plinth on floor slab (FS1_EW1_3)	0.20	0.15		−0.015	0.839
Exterior wall plinth on floor slab (FS1_EW1_4)	0.20	0.15		0.025	0.823
Internal wall integration into floor slab (FS1_FS1_IW_1)	0.20	0.20		0.006	0.940
Roof ridge pitched roof (RO1_RO1_ri_1)	0.13	0.13		−0.023	0.947
Roof ridge pitched roof (RO2_RO2_ri_1)	0.15	0.15		−0.022	0.943

Opaque Assemblies

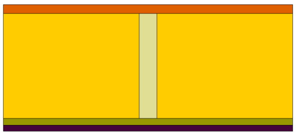
exterior wall (EW1)



Material	Lambda W/(m K)	Thickness (mm)
lime plaster 800 kg/m³	0.284	40
Upstraw_EW_straw & timber	0.054	340
clay plaster 1,800 kg/m³	0.910	40

Total thickness: 420 mm
Rsi: 0.13 m^2 K/W
Rse: 0.04 m^2 K/W
U-value: 0.15 W/(m^2 K)

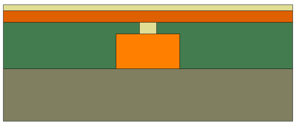
flat roof (FR1)



Material	Lambda W/(m K)	Thickness (mm)
insulation 050	0.050	30
Upstraw_RO1/FR/TC_straw & timber	0.053	360
Upstraw_FR_air & timber	0.143	24
Clay board	0.140	20

Total thickness: 434 mm
Rsi: 0.10 m^2 K/W
Rse: 0.10 m^2 K/W
U-value: 0.13 W/(m^2 K)

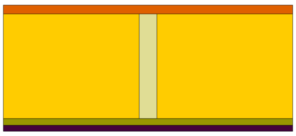
floor slab (FS1)



Material	Lambda W/(m K)	Thickness (mm)
softwood, OSB – perpendicular to grain direction	0.130	20
Upstraw_FS_cellulose & timber	0.056	40
Upstraw_FS_straw & timber pillars	0.042	160
concrete (1 % steel)	2.300	180

Total thickness: 400 mm
Rsi: 0.17 m^2 K/W
Rse: - m^2 K/W
U-value: 0.20 W/(m^2 K)

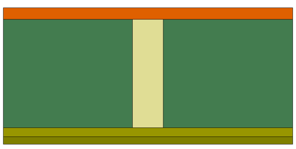
pitched roof (RO1)



Material	Lambda W/(m K)	Thickness (mm)
insulation 050	0.050	30
Upstraw_RO1/FR/TC_straw & timber	0.053	360
air cavity - heat flow upwards + 25.8% softwoo OSB – perpendicular to grain direction	0.145	24
Clay board	0.140	20

Total thickness: 434 mm
Rsi: 0.10 m^2 K/W
Rse: 0.10 m^2 K/W
U-value: 0.13 W/(m^2 K)

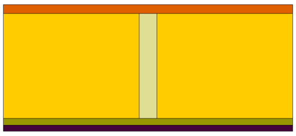
pitched roof (RO2)



Material	Lambda W/(m K)	Thickness (mm)
insulation 050	0.050	30
Upstraw_RO2_cellulose & timber	0.048	280
air cavity - heat flow upwards + 25.8% softwoo OSB – perpendicular to grain direction	0.145	24
FERMACELL gypsum fibre board	0.320	19

Total thickness: 353 mm
Rsi: 0.10 m^2 K/W
Rse: 0.10 m^2 K/W
U-value: 0.15 W/(m^2 K)

top floor ceiling (TC1)

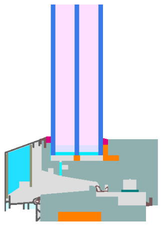


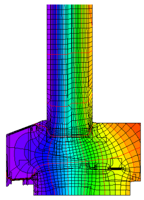
Material	Lambda W/(m K)	Thickness (mm)
insulation 050	0.050	30
Upstraw_RO1/FR/TC_straw & timber	0.053	360
air cavity - heat flow upwards + 25.8% softwoo	0.145	24
OSB – perpendicular to grain direction		
Clay board	0.140	20

Total thickness: 434 mm
Rsi: 0.10 m^2 K/W
Rse: 0.10 m^2 K/W
U-value: 0.13 W/(m^2 K)

Bottom

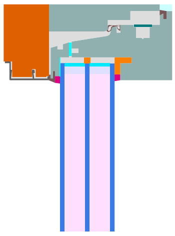
b_f = 76 mm
U_f = 0.93 W/(m^2 K)
Ψ_g = 0.020 W/(m K)
f_{Rsi} = 0.72

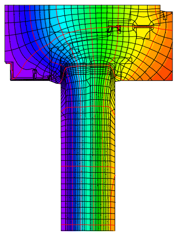




Top

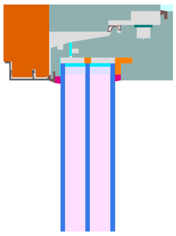
b_f = 67 mm
U_f = 0.71 W/(m^2 K)
Ψ_g = 0.021 W/(m K)
f_{Rsi} = 0.75

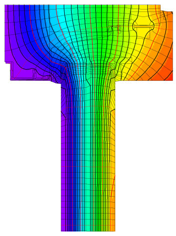




Lateral

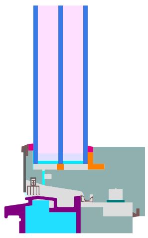
b_f = 67 mm
U_f = 0.71 W/(m^2 K)
Ψ_g = 0.021 W/(m K)
f_{Rsi} = 0.75

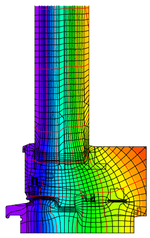




Threshold

b_f = 76 mm
U_f = 0.97 W/(m^2 K)
Ψ_g = 0.020 W/(m K)
f_{Rsi} = 0.72

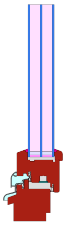


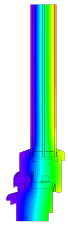


Frame Cuts with ”triple glazed oak window” from ”Fachverband Strohballenbau Deutschland e.V.” (1867wi03)

Bottom

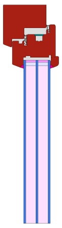
b_f = 131 mm
U_f = 1.86 W/(m^2 K)
Ψ_g = 0.028 W/(m K)
f_{Rsi} = 0.71

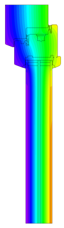




Top

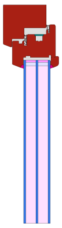
b_f = 114 mm
U_f = 1.55 W/(m^2 K)
Ψ_g = 0.029 W/(m K)
f_{Rsi} = 0.72

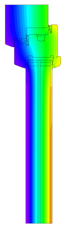




Lateral

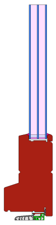
b_f = 114 mm
U_f = 1.55 W/(m^2 K)
Ψ_g = 0.029 W/(m K)
f_{Rsi} = 0.72

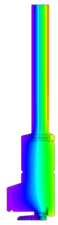




Threshold

b_f = 240 mm
U_f = 1.61 W/(m^2 K)
Ψ_g = 0.028 W/(m K)
f_{Rsi} = 0.57



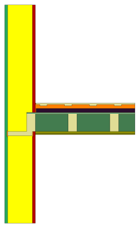


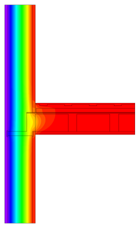
Ceiling integration

into exterior wall

(EW1_EW1_CE_1)

$$U_{EW1} = 0.15\,\mathrm{W/(m^2\,K)}$$
$$U_{EW1} = 0.15\,\mathrm{W/(m^2\,K)}$$
$$\Psi = 0.008\,\mathrm{W/(m\,K)}$$
$$f_{Rsi} = 0.929$$



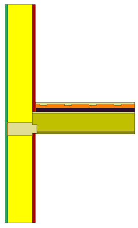


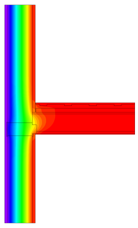
Ceiling integration

into exterior wall

(EW1_EW1_CE_1)

$$U_{EW1} = 0.15\,\mathrm{W/(m^2\,K)}$$
$$U_{EW1} = 0.15\,\mathrm{W/(m^2\,K)}$$
$$\Psi = 0.017\,\mathrm{W/(m\,K)}$$
$$f_{Rsi} = 0.920$$

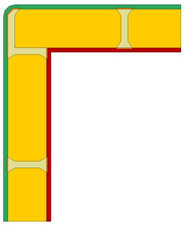


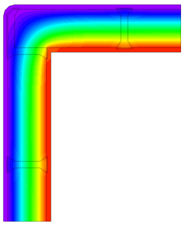


Exterior corner

exterior wall (EW1_EW1_ec_1)

$$U_{EW1} = 0.15\,\mathrm{W/(m^2\,K)}$$
$$U_{EW1} = 0.15\,\mathrm{W/(m^2\,K)}$$
$$\Psi = -0.085\,\mathrm{W/(m\,K)}$$
$$f_{Rsi} = 0.919$$

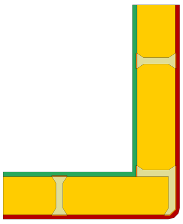




Interior corner

exterior wall (EW1_EW1_ic_1)

$$U_{EW1} = 0.15\,\mathrm{W/(m^2\,K)}$$
$$U_{EW1} = 0.15\,\mathrm{W/(m^2\,K)}$$
$$\Psi = 0.039\,\mathrm{W/(m\,K)}$$
$$f_{Rsi} = 0.957$$



Internal wall integration

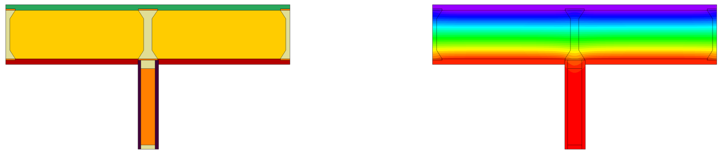
into exterior wall (EW1_EW1_IW_1)

U_{EW1} = 0.15 W/(m² K)

U_{EW1} = 0.15 W/(m² K)

Ψ = −0.001 W/(m K)

f_{Rsi} = 0.953



Roof parapet

flat roof (EW1_FR1_rp_1)

U_{EW1} = 0.15 W/(m² K)

U_{FR1} = 0.13 W/(m² K)

Ψ = −0.071 W/(m K)

f_{Rsi} = 0.905

Window bottom

operable window in exterior wall (EW1_OB1_1)

U_{EW1} = 0.15 W/(m² K)

U_{OB1} = 1.86 W/(m² K)

Ψ = 0.022 W/(m K)

f_{Rsi} = 0.616

Window bottom

operable window in exterior wall (EW1_OB1_2)

U_{EW1} = 0.15 W/(m² K)

U_{OB1} = 1.86 W/(m² K)

Ψ = 0.028 W/(m K)

f_{Rsi} = 0.823

Window head

operable window in exterior wall (EW1_OH1_1)

U_{EW1} = 0.15 W/(m² K)

U_{OH1} = 0.71 W/(m² K)

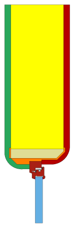
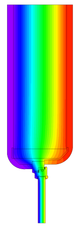
Ψ = 0.005 W/(m K)

f_{Rsi} = 0.865

Window head

operable window in exterior wall (EW1_OH1_1)

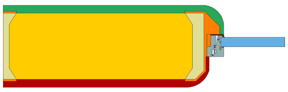
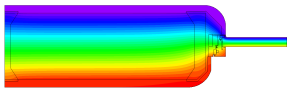
U_{EW1} = 0.15 W/(m^2 K)
U_{OH1} = 1.55 W/(m^2 K)
Ψ = 0.021 W/(m K)
f_{Rsi} = 0.715

Window jamb

operable window in exterior wall (EW1_OJ1_1)

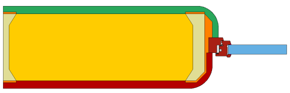
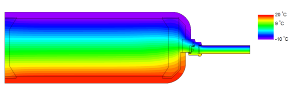
U_{EW1} = 0.15 W/(m^2 K)
U_{OJ1} = 0.71 W/(m^2 K)
Ψ = –0.001 W/(m K)
f_{Rsi} = 0.827

Window jamb

operable window in exterior wall (EW1_OJ1_1)

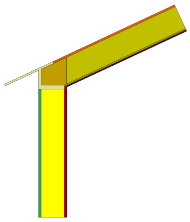
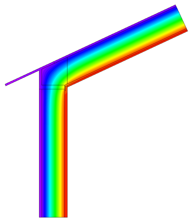
U_{EW1} = 0.15 W/(m^2 K)
U_{OJ1} = 1.55 W/(m^2 K)
Ψ = 0.015 W/(m K)
f_{Rsi} = 0.717

Roof eave

pitched roof (EW1_RO1_ea_1)

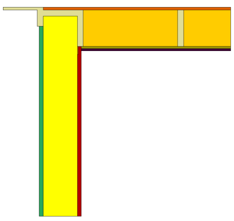
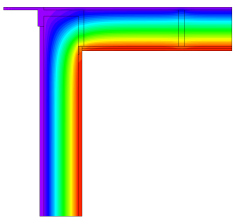
U_{EW1} = 0.15 W/(m^2 K)
U_{RO1} = 0.13 W/(m^2 K)
Ψ = –0.033 W/(m K)
f_{Rsi} = 0.911

Roof verge

pitched roof (EW1_RO1_ve_1)

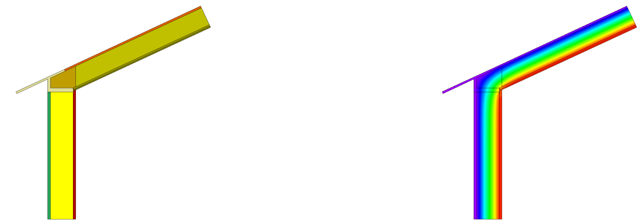
U_{EW1} = 0.15 W/(m^2 K)
U_{RO1} = 0.13 W/(m^2 K)
Ψ = –0.075 W/(m K)
f_{Rsi} = 0.896

Roof eave

pitched roof (EW1_RO2_ea_1)

U_{EW1} = 0.15 W/(m² K)
U_{RO2} = 0.15 W/(m² K)
Ψ = –0.026 W/(m K)
f_{Rsi} = 0.913



Roof verge

pitched roof (EW1_RO2_ve_1)

U_{EW1} = 0.15 W/(m² K)
U_{RO2} = 0.15 W/(m² K)
Ψ = –0.067 W/(m K)
f_{Rsi} = 0.892

Roof eave

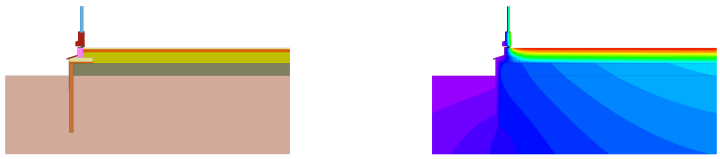
exterior wall to top ceiling with cold roof (EW1_TC1_RO_ea_2)

U_{EW1} = 0.15 W/(m² K)
U_{TC1} = 0.13 W/(m² K)
Ψ = –0.069 W/(m K)
f_{Rsi} = 0.905

Threshold

to floor slab (FS1_EW1_OT1_1)

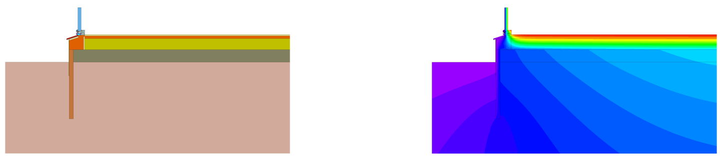
U_{FS1} = 0.20 W/(m² K)
U_{EW1} = 0.15 W/(m² K)
U_{OT1} = 1.61 W/(m² K)
Ψ = 0.016 W/(m K)
f_{Rsi} = 0.575



Threshold

to floor slab (FS1_EW1_OT2_1)

U_{FS1} = 0.20 W/(m² K)
U_{EW1} = 0.15 W/(m² K)
U_{OT2} = 0.97 W/(m² K)
Ψ = –0.025 W/(m K)
f_{Rsi} = 0.772



Exterior wall plinth

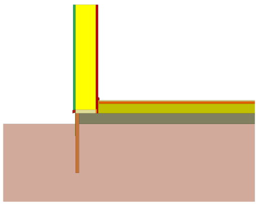
on floor slab (FS1_EW1_1)

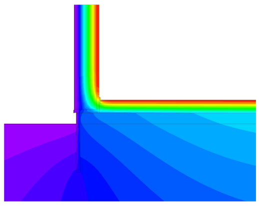
U_{FS1} = 0.20 W/(m^2 K)

U_{EW1} = 0.15 W/(m^2 K)

Ψ = –0.034 W/(m K)

f_{Rsi} = 0.844





Exterior wall plinth

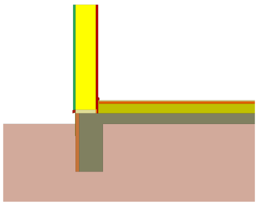
on floor slab (FS1_EW1_2)

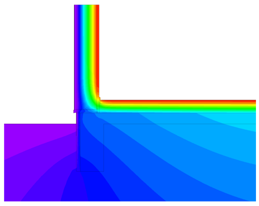
U_{FS1} = 0.20 W/(m^2 K)

U_{EW1} = 0.15 W/(m^2 K)

Ψ = –0.032 W/(m K)

f_{Rsi} = 0.844





Exterior wall plinth

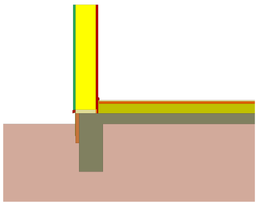
on floor slab (FS1_EW1_3)

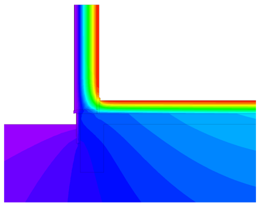
U_{FS1} = 0.20 W/(m^2 K)

U_{EW1} = 0.15 W/(m^2 K)

Ψ = –0.015 W/(m K)

f_{Rsi} = 0.839





Exterior wall plinth

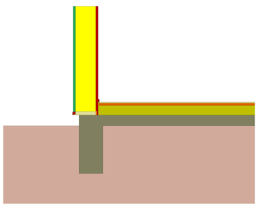
on floor slab (FS1_EW1_4)

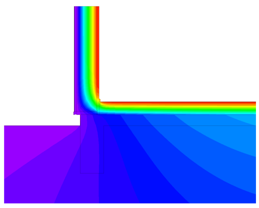
U_{FS1} = 0.20 W/(m^2 K)

U_{EW1} = 0.15 W/(m^2 K)

Ψ = 0.025 W/(m K)

f_{Rsi} = 0.823





Internal wall integration

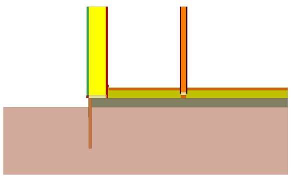
into floor slab (FS1_FS1_IW_1)

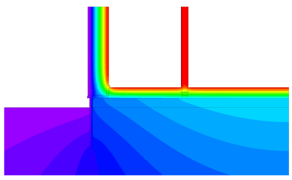
U_{FS1} = 0.20 W/(m^2 K)

U_{FS1} = 0.20 W/(m^2 K)

Ψ = 0.006 W/(m K)

f_{Rsi} = 0.940





Roof ridge

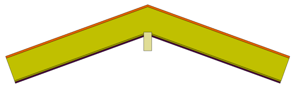
pitched roof (RO1_RO1_ri_1)

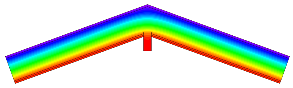
U_{RO1} = 0.13 W/(m² K)

U_{RO1} = 0.13 W/(m² K)

Ψ = –0.023 W/(m K)

f_{Rsi} = 0.947





Roof ridge

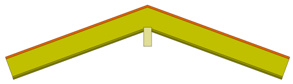
pitched roof (RO2_RO2_ri_1)

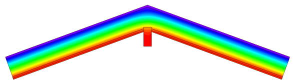
U_{RO2} = 0.15 W/(m² K)

U_{RO2} = 0.15 W/(m² K)

Ψ = –0.022 W/(m K)

f_{Rsi} = 0.943





Disclaimer: The Passive House Institute GmbH (PHI) carries out heat transfer analyses according to the standards set out in the document "Criteria and Algorithms for Certified Passive House Components: Opaque Construction Systems" and based on information provided by the manufacturer. It is the responsibility of the project leader, e.g. the architect to ensure the appropriate assessments have been carried out for specific buildings, which may include more detailed analyses than those carried out for this certification. Use of a certified Passive House component does not guarantee that a construction project will achieve the Passive House, EnerPHit or PHI Low Energy Building standard. In all cases full details are to be made available by the manufacturer on request to the engaged certified Passive House designer or certifier, who will be permitted to check these against the construction information and to perform on-site checks as part of the quality assurance process.